CLAIMS

What is claimed is:

1   1.   A method of prediction of a process having an associated process metric, the
2   method comprising the steps of:
3   (a) obtaining time-varying measurements of parameters relating to the process;
4   (b) decomposing the time-varying measurements into discrete measurement
5   values using an orthogonal transform; and
6   (c) modeling a relationship between the discrete measurement values and the
7   associated process metric to determine a predicted process metric value from an input set
8   of discrete measurement values.

1   2.   The method of claim 1 wherein the modeling step comprises building a nonlinear
2   regression model of the relationship between the discrete measurement values and the
3   associated process metric to determine the predicted process metric value.

1   3.   The method of claim 1 wherein the orthogonal transform is a Fourier transform.

1   4.   The method of claim 1 wherein the orthogonal transform is a wavelet transform.

1   5.   The method of claim 1 further comprising the steps of:
2   (d) providing at least one range of acceptable discrete measurement values to
3   define a constraint set;
4   (e) identifying a plurality of input process variable values that produce discrete
5   measurement values within the constraint set; and
6   (f) using the modeled relationship in conjunction with an optimizer to determine
7   the discrete measurement values, produced by the input process variable values, that
8   produce a predicted process metric value substantially as close as possible to a target
9   process metric value.

1   6.   The method of claim 5, further comprising the step of repeating steps (a)-(e) for at
2   least one sub-process of the process.

1   7.   The method of claim 5, further comprising the step of repeating steps (a)-(e) for a
2   higher-level process comprising a plurality of the processes.

1 8. The method of claim 1 wherein the input set of discrete measurement values is
2 obtained by decomposing time-varying measurements into discrete measurement values
3 using an orthogonal transform.

1 9. An article of manufacture having a computer-readable medium with computer-
2 readable instructions embodied thereon for performing the method of claim 1.

1 10. A method of prediction and optimization of maintenance actions for a process, the
2 method comprising the steps of:
3   (a) obtaining time-varying measurements of parameters relating to the process;
4   (b) decomposing the time-varying measurements into discrete measurement
5 values using an orthogonal transform; and
6   (c) modeling a relationship between at least one maintenance variable and the
7 discrete measurement values to determine predicted measurement values from an input
8 set of maintenance variable values.

1 11. The method of claim 10 wherein the modeling step comprises building a
2 nonlinear regression model of the relationship between at least one maintenance variable
3 and the discrete measurement values to determine the predicted measurement values.

1 12. The method of claim 11 wherein the nonlinear regression model maps a
2 relationship between (i) a plurality of maintenance variables and associated process
3 inputs, and (ii) discrete measurement values, the nonlinear regression model being used
4 to determine a predicted measurement value from an instance of the input set of
5 maintenance-variable values.

1 13. The method of claim 12 wherein the orthogonal transform is a Fourier transform.

1 14. The method of claim 12 wherein the orthogonal transform is a wavelet transform.

1 15. The method of claim 12 further comprising the steps of:
2   (d) providing at least one range of acceptable values for at least one maintenance
3 variable to define a constraint set; and
4   (e) using the modeled relationship in conjunction with an optimizer to determine
5 values for the at least one maintenance variable within the constraint set that produce at
6 least one predicted discrete measurement value substantially as close as possible to a
7 target discrete measurement value.

1   16.   The method of claim 15, wherein costs are associated with at least one of the
2   maintenance values used by the optimizer.

1   17.   The method of claim 10 further comprising modeling a relationship between (i) an
2   input set comprising at least one maintenance variable and the discrete measurement
3   values and (ii) the process inputs in order to determine a predicted process metric value
4   from an instance of the input set.

1   18.   An article of manufacture having a computer-readable medium with computer-
2   readable instructions embodied thereon for performing the method of claim 10.

1   19.   A system for predicting a process having an associated process metric,
2   comprising:
3   (a) a process monitor for monitoring time-varying measurements relating to
4   process metrics; and
5   (b) a data processing device for predicting the process by (i) decomposing the
6   time-varying measurements into discrete measurement values using an orthogonal
7   transform, and (ii) modeling a relationship between the discrete measurement values and
8   the associated process metric to determine a predicted process metric from an input set of
9   discrete measurement values.

1   20.   The system of claim 19 further comprising a process controller, responsive to the
2   data processing device, for adjusting at least one of the processes based on the predicted
3   process metric.

1   21.   The system of claim 19 further comprising a data storage device for providing at
2   least one range of acceptable discrete measurement values.

1   22.   The system of claim 21 further comprising an optimizer for determining values
2   for the process inputs that (i) produce predicted discrete measurement values
3   substantially as close a possible to a target value provided by the data storage device.

1   23.   The system of claim 22 wherein the optimizer is a feature of the data processing
2   device.

1   24.   A system for predicting and optimizing maintenance actions for a process,
2   comprising:

3   (a) a process monitor for monitoring time-varying measurements of parameters

4 relating to the process; and

5   (b) a data processing device for predicting the process by (i) decomposing the

6 time-varying measurements into discrete measurement values using an orthogonal

7 transform and (ii) modeling a relationship between at least one maintenance variable and

8 the discrete measurement values to determine predicted measurement values from an

9 input set of maintenance values.

1 25. The system of claim 24 further comprising a process controller, responsive to the

2 data processing device, for adjusting at least one of the processes based on the predicted

3 process metric.

1 26. The system of claim 24 further comprising a data storage device for providing at

2 least one range of acceptable discrete measurement values.

1 27. The system of claim 26 further comprising an optimizer for determining

2 measurement values that (i) produce a predicted process metric value substantially as

3 close a possible to a target process metric, and (ii) are within the at least one range of

4 acceptable values for the discrete measurement values provided by the data storage

5 device.